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HAND RAIL SYSTEM

Sub A2> Reference to Related Applications

This application claims priority from provisional patent application Serial No. 60/191,704, filed March 23, 2000; and is a continuation-in-part of co-pending U.S. patent application Serial No. 09/394,595, filed September 13, 1999, which is a continuation-in-part of U.S. patent application Serial No. 08/870,101, filed June 5, 1998, the entire contents of all of which are incorporated herein by reference.

Sub A3> Field of the Invention

The present invention is directed to a knock-down hand rail system. More particularly, the present invention relates to a unique knock-down hand rail system for use both indoors and outdoors.

Sub A4> Background of the Invention

The typical hand rail is formed of metal and susceptible to affects of weather or other environmental conditions causing the rail to rust and deteriorate. A disadvantage of these metal rails is that such rails require regular upkeep such as painting to prevent rust or complete replacement when the metal rusts away.

To overcome this, galvanized steel has been used to avoid rust and hopefully, eliminate regular upkeep. A disadvantage of galvanized steel is that the sheen is too bright

and is distracting when used in environments such as auditoriums or stadiums.

A still further disadvantage of both the metal and galvanized steel hand rail systems is that their assembly is of a permanent nature. That is, once the rail structure is assembled, the rail is permanently fixed at that location in that configuration.

There is a need for fence or barrier assemblies to support a panel, such as a sheet of glass, perforated metal, or steel mesh. Such an assembly can be used to protect equipment, prevent personnel from falling through an opening or over a ledge, and to block passage of unwanted materials or objects. U.S. Patent No. 6,138,993 to Mitchell, Jr. et al. shows a protection screen that includes a plurality of screen panels and is self-supporting. This screen has limited utility, lacks a heavy-duty steel support frame surrounding the panel, does not provide for interchange of panels, and does not have a sheathing or covering to protect a support frame. U.S. Patent No. 5,967,214 to Berretta discloses a barrier with a tubular frame and an extruded sheet-like element shaped into a closed loop that may be fitted over the tubular frame. This barrier also has limited utility, is not adjustably configurable, and lacks sheathing on the tubular members. The panels also are shrink-fit to the frame making interchangeability difficult. U.S. Patent No. 5,967,089 to Alan discloses a lightweight, collapsible, hinged fencing structure that includes multiple rectangular panels that are hingedly interconnected. Each panel consists of a plastic tubular frame with a lightweight polymeric sheet supported by the frame. This structure again has a limited utility and is not flexibly configurable. The plastic frame also lacks the requisite strength for application

where a steel frame is required. U.S. Patent No. 4,841,967 to Hogg et al. discloses a glass panel mounting assembly that forms a glass barrier with a rail at the top edge. The glass panel forms a decorative barrier that lacks the requisite strengths for many applications. It is not flexibly configurable, and lacks a steel surrounding frame. In light of the above, there remains a need for a barrier assembly that is adjustably configurable, has steel frame members interconnected with one another, and a plastic sheathing over the rails, and supports a panel.

Sub A5>

Summary of the Invention

The present invention provides a knock-down hand rail assembly that is formed of both metal and plastic. The hand rail assembly is readily and easily assembled and disassembled. The hand rail is maintenance free and requires no paint or other upkeep.

The assembly of the present invention can be used in many applications both indoor and out. The hand rail assembly can readily be assembled anywhere. The assembly can also readily be disassembled to form a different hand rail structure configuration or to add more rails to the structure. Further, the hand rail can be readily disassembled to change the plastic for the purpose of changing colors of the rail or adding/subtracting signage provided on the structure. This is advantageous when using the invention in an auditorium setting. The ability to color code railings with seating makes it easier on attendees to find their seats during a game or show. The knock down hand rail assembly of the present invention includes at least two spaced apart vertical rails and at least two base supports for supporting

the vertical rails in an upright position. Alternatively, the vertical rails may be supported by the ground using standard coring procedures. At least two spaced apart horizontal rails are provided and removably engaged with the vertical rails. These horizontal rails are preferably positioned above the base supports. Each vertical and horizontal rail is surrounded by removable and replaceable polymerized sheathing. The polymerized sheathing has an interior diameter equal to or greater than the outer diameter of each rail. Slip-on structural fittings are provided to removably engage the horizontal rails to the vertical rails. In other preferred embodiments, a plurality of vertical and horizontal rails surrounded by polymerized sheathing and engaged by slip-on structural fittings can be used.

In yet other preferred embodiments of the present invention, vertical and horizontal posts or rails form a perimeter frame and define a framed area. An infill panel is supported in the framed area. The infill panel may be a sheet of glass or polymer, steel mesh, or perforated steel. In some versions, slip-on structural fittings engage and removably interconnect the horizontal and vertical rails. Clips or brackets interconnect to the infill panel with the vertical and horizontal rails. In other embodiments, slip-in structural fittings are provided that have one end that engages the inner diameter of a horizontal or vertical rail, and another end that mounts to the side of another rail. These and other objects, advantages and features of this invention will become apparent upon review of the following specification in conjunction with the drawings.

Sub A2> Brief Description of the Drawings

FIGURE 1 is a perspective view of the hand rail assembly of the present invention;

FIGURE 2 is an exploded view of a preferred embodiment of the hand rail assembly of the present invention;

FIGURE 3 is a cross-sectional view taken along line 3-3 of Figure 1;

FIGURE 4 is a perspective view of a second preferred embodiment of the hand rail assembly of the present invention;

FIGURE 5 illustrates, from an oblique perspective, an alternative embodiment of the invention including a mesh infill;

FIGURE 6 is a close-up detail of the corner of the assembly of Figure 5;

FIGURE 7 illustrates an alternative way of forming U-channels according to the invention to ensure that there are no gaps in the infill;

FIGURE 8 illustrates the use of clips as opposed to full-length channels, and an alternative corner gap-filling corner configuration;

FIGURE 9 is a perspective view of another preferred embodiment of a barrier assembly with an infill panel according to the present invention;

FIGURE 10 is an end view of the barrier assembly of Figure 9;

FIGURE 11 is a front elevational view of the barrier assembly of Figure 9;

FIGURE 12 is a top plan view of the barrier assembly of Figure 9;

FIGURE 13 is a bottom plan view of the barrier assembly of Figure 9;

FIGURE 14 is a perspective view of another embodiment of a barrier assembly with an infill panel according to the present invention, utilizing an alternative slip-in structural fitting;

FIGURE 15 is an end view of the barrier assembly of Figure 14;

FIGURE 16 is a front elevational view of the barrier assembly of Figure 14;

FIGURE 17 is top plan view of the barrier assembly of Figure 14;

FIGURE 18 is a bottom plan view of the barrier assembly of Figure 14;

FIGURE 19 is a detailed end view of one embodiment of a clip for holding an infill panel for a barrier assembly according the present invention;

FIGURE 20 is a detailed perspective view of a slip-in structural fitting interconnecting a horizontal and vertical rail;

FIGURE 21 is a detailed perspective view of another slip-in structural fitting interconnecting a horizontal and vertical rail, along with an end cap closing the end of a horizontal rail;

FIGURE 22 is an exploded perspective view of a portion of a horizontal and vertical rail along with a slip-in structural fitting; and

FIGURE 23 is a detailed view of an alternative embodiment of a slip-in structural fitting.

Sub A7> Detailed Description of the Invention

With reference to Figures 1 and 2, a knock down hand rail system 10 is thereshown.

In this first preferred embodiment, at least two spaced apart vertical rails 12, 14 are provided and supported in an upright position by base supports 16, 18. These base supports 16, 18 provide removable and replaceable support with the ground 20 and are preferably secured to the ground 20 by bolts 22. Alternatively, the hand rail assembly can be cored to the ground for support.

The hand rail assembly of the present invention also includes at least two spaced apart horizontal rails 24, 26 removably engaged with vertical rails 12, 14 and positioned above base supports 16, 18.

As shown in Figure 2, vertical rails 12, 14 are surrounded by removable and replaceable polymerized sheathing 28, 30. This sheathing 28, 30 preferably slip fits about vertical rails 12, 14 and has an interior diameter equal to or greater than the exterior diameter of vertical rails 12, 14. This aspect of the invention will be described in greater detail below.

As with vertical rails 12, 14, corresponding horizontal rails 24, 26 are also surrounded by polymerized sheathing 32, 34 respectively. Additionally, this polymerized sheathing has an interior diameter that is equal to or greater than the exterior diameter of horizontal rails 24, 26. As stated above, this slip fit of the polymerized sheathing 32, 34 about horizontal rails 24, 26 will be described in detail later.

Slip-on structural fittings 36, 40 are provided to removably engage horizontal rails 24, 26 to each other and to vertical rails 12, 14. These slip-on structural fittings are preferably Hollaender structural fittings manufactured by The Hollaender Manufacturing

Company, Cincinnati, Ohio. T-shaped slip-on structural fitting 36 may be provided to join horizontal rail 24 to horizontal rail 26 and include an extra opening for additional vertical rails if desired. T-shaped slip-on structural fitting 36 removably engages horizontal rails 24, 26 and polymerized sheathing 32, 34 by set screws 38.

L-shaped Hollaender slip-on structural fittings 40 removably engage horizontal rails 24, 26 to vertical rails 12, 14. L-shaped slip-on structural fittings 40 removably secure the rails to each other by set screws 42.

With reference to Figure 3, each slip-on structural fitting provided to removably secure the knockdown hand rail system 10 of the present invention typically includes a structural fitting 40 for securing horizontal rail 24 with polymerized sheathing 32 to vertical rail 14 with polymerized sheathing 30. More specifically, interior diameter 44 of polymerized sheathing 32 is equal to or greater than exterior diameter 46 of horizontal rail 24. Additionally, interior diameter 48 of L-shaped slip-on fitting 40 is equal to or greater than the exterior diameter 50 of polymerized sheathing 32. Set screw 42 is preferably a counter bore knurled cup point set screw that securely fastens L-shape slip-on fitting 40 through polymerized sheathing 32 onto horizontal rail 24. This structural assembly is typical of all rails, polymerized sheathing, and slip-on fittings of the present invention.

In a second preferred embodiment of the present invention, a third vertical rail 52 may be provided therewith. Vertical rail 52 is also preferably surrounded by polymerized sheathing 54 having an interior diameter equal to or greater than the exterior diameter of

vertical rail 52. Vertical rail 52 is typically provided with base support 56 for supporting vertical rail 52 in an upright position. Base support 56 may be secured to the ground 20 by bolts 22 as typically shown in base supports 16, 18.

Vertical rail 52 with polymerized sheathing 54 may be provided with a cross-shaped slip-on structural fitting 70 for supporting additional horizontal rails 58, 60. These horizontal rails 58, 60 are also preferably surrounded by polymerized sheathing 62, 64 respectively. As with all polymerized sheathing of the present invention, polymerized sheathing 62, 64 has an interior diameter equal to or greater than the exterior diameter of horizontal rails 58, 60. Cross-shaped slip-on structural fitting 70 removably secures horizontal rails 58, 60 with polymerized sheathing 62, 64 to third vertical rail 52 with polymerized sheathing 54 by set screws 72. Horizontal rails 58, 60 with polymerized sheathing 62, 64 are secured to vertical rails 12, 14 with polymerized sheathing 28, 30 by T-shaped slip-on structural fittings 66 with set screws 68.

Proper assembly of the preferred present invention is as follows. Vertical rails 12, 14, 52 are spaced apart and supported in an upright position by base supports 16, 18, 56. These base supports are removably secured to the ground 20 by any mechanical means such as bolts 22. Removable and replaceable polymerized sheathing 28, 30, 54 is preferably slip-fit about corresponding vertical rails 12, 14, 52. T-shaped slip-on structural fittings 66 are slipped over polymerized sheathing 28, 30 to be secured and positioned later.

Horizontal rails 24, 26 are provided therewith and surrounded by corresponding

polymerized sheathing 32, 34. One end of each horizontal rail is secured to L-shaped slip-on fitting 40 by a corresponding set screw 42. The opposite end of horizontal rails 24, 26 with corresponding polymerized sheathing 32, 34 is secured to a T-shaped slip-on fitting 36 by corresponding set screws 38. The entire removably secured structure of these horizontal rails is then placed atop corresponding vertical rails 12, 14, 52 with polymerized sheathing 28, 30, 54 respectively. Remaining set screws 38, 42 removably attach the horizontal rail structure to the vertical rail structure. Lastly, horizontal rails 58, 60 are surrounded by polymerized sheathing 62, 64 respectively. Each horizontal rail 58, 60 with corresponding polymerized sheathing 62, 64 are removably secured between vertical rails 12, 14, 52 with corresponding polymerized sheathing 28, 30, 54 by slip-on structural fittings 66, 70. Set screws 68, 72 removably engage these additional horizontal rails to the vertical rails at any point along the vertical rails.

An alternative embodiment of the present invention involves extension and bending of vertical rails 28, 30 to form horizontal rail 34, as shown in Figure 4. That is, inner frame vertical rail 12, 14 is slip-fit into corresponding polymerized sheathing 28, 30 and is then bent to create a rounded corner and thereby extend into a horizontal rail. In this way, Hollaender fittings 40 would be eliminated and horizontal rails 24, 26 with corresponding polymerized sheathing 32, 34 would be replaced by extended vertical rails 12, 14 with polymerized sheathing 28, 30 to meet at Hollaender fittings 36. In an extended version of this preferred embodiment, Hollaender fitting 36 may be provided to simply support vertical

rail 52 with polymerized sheathing 54 to the singularly extended vertical rail 12 with corresponding sheathing 28. In this embodiment, vertical rail 12 would then extend to form both exterior vertical rails 12, 14 and horizontal rails 24, 26. A singular unit of polymerized sheathing would also extend about the singular rail and be bent to form rounded corners at the upper edges.

Alternative embodiments of the present invention may involve the use of only one top horizontal rail or several horizontal and vertical rails extending to create an elongated hand rail assembly 10. It was envisioned that each vertical rail will be removably supported to the ground by a base or structure if necessary. Additional base structures are also shown in Figure 4. Moreover, each additional horizontal rail is preferably supported to the vertical rails by Hollaender slip-on structural fittings conforming to any shape necessary to create the overall structural shape of the hand rail assembly of the present invention. That is, the hand rail of the present invention may extend linearly, triangularly, circularly, or any other shape that may reasonably be configured. Moreover, each rail, vertical and horizontal, shall preferably be surrounded by polymerized sheathing having an interior diameter that is equal to or greater than the exterior diameter of the corresponding rail.

Figure 5 illustrates, from a perspective view, an alternative embodiment of the invention generally at 102 including an infill disposed between the horizontal and vertical sheathing-covered rails 30 and 34. Although the embodiment depicted in Figures 5 and 6 illustrate the use of a mesh panel 106 received by continuous channels 104, it is readily

apparent that the arrangement is conducive to the use of other types of infills, including clear and opaque plastics, glass, and meshes and perforated sheets having apertures of any scale, depending upon the application.

Figure 6 is a close-up view of the way in which the channels 104 attach to the rails 30 and 34, and the way in which infill 106 is received thereby. Preferably, a plurality of spaced-apart self-tapping fasteners 105 are used to adhere the U-channels 104 to the members as shown. Since the fasteners 105 must go through the U-channel material, sheathing and wall of the associated rail, it may be advisable to predrill holes for each fastener, as the case may be. Although the material used for the infill may not include a finished edge, particularly when mesh panels are used, it is preferable to have a peripheral seam 108 to provide a more finished look. In terms of materials, the U-channels 104 are preferably constructed of some type of corrosion-resistant metal such as aluminum, though other types of metals and even non-metals may be used, so long as they are of sufficient strength and durability.

To fill the triangular gap which would otherwise be left due to the difference in height between the sheath covered rails and corner/T-assemblies 40 and 46, a configuration such as that depicted in Figure 7 may alternatively be utilized. In this case, the U-channels 112 include relieved areas 114 such that, when assembled, a cleaner full corner appearance is achieved. In such a case, an infill having a square corner may be used, such as mesh screen 120 having a finished squared-off corner 122.

Figure 8 illustrates certain additional alternative configurations according to the

invention, which may be used independently or in combination with other arrangements described herein. For example, in place of a continuous U-channel, clips 140 may alternatively be used, particularly if the edge of the infill is peripherally finished or otherwise continuous. As a further option, the edge of the infill may be scalloped, as shown at 150. With such a shaped configuration, which may be used with clips or a continuous U-channel, the triangularly shaped gap shown in Figures 5 and 6 would be filled without having to grind or otherwise modify the U-channel or clip members.

Referring now to Figure 9-13, an additional embodiment of a knock down hand rail system according to the present invention is generally shown at 200. The hand rail system has a pair of spaced apart vertical rails 202 and 204, each covered with a polymerized sheathing, as previously described. An upper rail 206 extends horizontally between the upper ends of the vertical posts 202 and 204 and is also covered with a removable and replaceable polymerized sheathing. Slip-on structural fittings 208 and 210 interconnect the ends of the upper rail 206 with the upper ends of the vertical posts 202 and 204, respectively. A lower rail 212 extends horizontally between the vertical posts 202 and 204 and is covered with a polymerized sheathing. It is interconnected at its ends with the vertical posts 202 and 204 using T-shaped slip-on structural fittings 214 and 216, respectively. The T-shaped fittings 214 and 216 may be moved upwardly and downwardly so as to change the spacing between the lower rail 212 and the upper rail 206. Though not shown, the structural fittings 208, 210, 214, 216 preferably includes screws or bolts that allow the fittings to grip the

vertical and horizontal rails to which they connect. Preferably, the screws or bolts do not penetrate the polymerized sheathing or the rails or posts.

The vertical posts 202 and 204 and the upper and lower rails 206 and 212 together define a perimeter frame with a framed area 218 defined therein. The framed area has a top edge defined by the upper rail 206, a lower edge defined by the lower rail 212, and sides defined by the vertical post 202 and 204. An infill member or panel 220 is supported in the framed area. As previously discussed, the infill member or panel 220 may be any of a variety of materials including a glass, polymer, or perforated steel or plastic sheet, or a steel or fiberglass mesh. In the embodiment illustrated in Figure 9, the panel 220 is a piece of steel or plastic with perforations. The panel 220 is supported in the framed area by a variety of clips 222. Each clip 222 grips an edge of the panel 220 and interconnects with one of the posts or rails. The illustrated infill panel 220 may be eliminated in some applications, with the vertical posts and horizontal rails acting as a hand rail.

In the illustrated embodiment, the lower ends of the vertical posts 202 and 204 extend downwardly below the underside of the lower rail 212. This design is configured so that the lower ends of the vertical post 202 and 204 fit into holes in a support surface. Alternatively, support members may be attached to the lower ends of the vertical posts 202 and 204.

Referring now to Figures 14-18, another embodiment of a knock down hand rail system with an infill panel according to the present invention is generally shown at 230. The hand rail system 230 is similar to the previous embodiments, and includes a pair of vertical

posts 232 and 234, an upper rail 236 extending between the upper ends of the vertical post 232 and 234, and a lower rail 238 positioned below the upper rail 236 and also extending between the vertical posts 232 and 234. This embodiment differs from the prior embodiment in that the infill panel 240 is a sheet of glass or plastic, support members 242 and 245 engage the lower ends of the vertical post 232 and 234, respectively, and, most importantly, a different type of structural fitting is used to interconnect the rails and posts.

As with the previous embodiment, clips 246 interconnect the infill panel 240 with the rails and posts. Figure 19 shows an end view of a clip 246. A clip 246 in Figure 19 is oriented as are the clips that interconnect the infill panel with the upper rail 236 in Figure 14. In this orientation, the clip 246 has an upper end 248 that is radiused so as to mate with the outer radius of the polymerized sheathing surrounding the upper rail 236. A bolt or screw, not shown passes through a bore 250 in the upper end and engages the upper rail 236. The lower end 252 of the clip has a slot-like opening 254 that accepts the edge of the infill panel 240. The width of the slot 254 depends on the thickness of the panel 240. Alternatively, the clip may be made adjustable to accommodate variations in thickness of infill panels, or the slot 254 may be lined to improve the engagement between the clip and panel. For example, a glass panel may require a rubberized lining in the clips to avoid chipping the edges of the glass.

Referring now to Figures 20-23, the alternative structural fitting used with the hand rail system of Figures 14-18 will be described in more detail. Figure 20 is a detailed view of

one of the lower corners of the hand rail system of Figure 14 showing the support member 242 supporting the lower end of vertical post 232 which extends upwardly from the support member 242. The horizontal lower rail 238 is interconnected with the vertical post 232 just above the support member 242 using a structural fitting 260. The structural fitting 260 differs from the previous slip-on structural fitting in that it is a much more flush design.

Figure 22 shows an exploded view of an interconnection similar to that of Figure 20. A portion of vertical post 232 is shown with structural fitting 260 engaged to its side. The structural fittings may be oriented in various positions. However, for ease of description, the fitting 260 will be described in the orientation illustrated, with such terms as left and right being arbitrary. The fitting 260 has a base 262 at its left end and engagement members 264 at its right end. The base 262 has an end surface that is radiused so as to mate with the outer surface of the sheathing covering the vertical post 232. A bore, not shown, passes through the base 262. A bolt or screw 268 passes through this bore and engages the vertical post 232. The bolt or screw 268 may be self-threading, or may require that a hole be drilled and/or tapped in the post 232. The bolt 268 engages the hole in the post 232 and brings the radiused end surface 266 of the base 262 into firm contact with the side of the post 232. Engagement members 264 extend rightwardly out of the base 262. The engagement members 264 include a pair of engagement fingers 270 and 272. Each finger 270 and 272 has a semi-arcuate outer profile configured to engage the interior diameter of the lower rail 238. As illustrated, the rail 238 has an inner steel rail 274 and a polymerized sheathing 276 surrounding the rail 274.

The steel rail 274 has an inner diameter. The fingers 270 and 272 engage this inner diameter. The fingers 270 and 272 may be tapered or shaped so as to be a press fit into the rail 274, or may slide easily thereinto. A bolt or screw 278 interconnects the lower rail 238 with the fingers 270 and 272. In one embodiment, a hole 280 is provided in the lower finger 270. The lower rail 238 is slid onto the fingers 270 and 272. A hole is then drilled through the combination of the rail 274 and sheathing 276 so that the screw 278 can engage the hole 280. Alternatively, the screw may be self-tapping and make its own hole in the sheathing 276, rail 274, and/or the finger 270. The holes may also be pre-drilled in the ends of the rail 238. For some applications, a screw or bolt may not be required to maintain assembly of the hand rail. A press fit may be sufficient or adhesives may be used to interconnect the rail to the fitting. As another alternative, the screw 278 may engage the hole 280 in the lower finger 270 and, when sufficiently tightened, press against the upper finger 272, thereby spreading the fingers 270 and 272 apart so as to securely engage the inner diameter of the rail 274. Referring again to both Figures 20 and 22, it can be seen that the base 262 of the fitting 260 has an outer diameter similar to the outer diameter of the sheath 276 of the rail 238 so that, when assembled, the fitting 260 and the lower rail 238 have flush outer diameters giving a very pleasing appearance.

Referring now to Figure 21, a detailed view of an upper corner of the hand rail system of Figures 14-18 is shown. The upper end of one of the vertical posts 234 is shown interconnected with one end of the upper rail 236 using another slip-in structural fitting 290.

The slip-in structural fitting 290 is the same as shown in Figure 22, though the orientation has been changed. An end cap 292 is also provided that closes the open end of the upper rail 236 where it extends beyond the upper end of the vertical post 234 and the fitting 290.

Referring now to Figure 23, alternative structural fitting 294 is shown. The fitting 294 is again a slip-in fitting, but is designed to form a corner without the need for the end cap 292 shown in Figure 21. Instead, the fitting 294 has a first pair of fingers 296 extending in a first direction and a second set of fingers 298 extending in a second direction, with the second direction positioned at 90 degrees to the first direction. As will be clear to those of skill in the art, other slip-in structural fittings may be provided, such as T-shaped fittings, or fittings that support any number of structural members at any number of angles. As a further alternative, a T-shaped fitting may be provided with the leg of the T including slip-in fingers while the "top" of the T is a slip-on structural fitting. This combines the benefits of the slip-on and slip-in fittings. It gives a flush appearance between the fitting and a member that extends in one direction, but allows adjustment where the "top" of the T engages another member. Any of these slip-in fittings may be used in any embodiments of the present invention.

The above description is considered that of the preferred embodiment only. Modifications of the invention may occur to those of ordinary skill in the art. Therefore, it is understood that the embodiments shown in the drawing and described above are merely for illustration purposes and are not intended to limit the scope of the invention.